CLAIMS:

1. Transceiver apparatus (1, 1′) for use in a multi-frequency communication system, comprising:

- a signal processor (DDS)
- a frequency conversion circuitry (3, 3′)
- an antenna-switch (SW, SW′), and
- an antenna terminal (AT, AT′) having at least one antenna (A, A_1, A_2, A_3, A_4) characterized in that
- the frequency conversion circuitry (3, 3′) has a transmission path (Tx, Tx′) and a reception path (Rx, Rx′), wherein each of the paths communicatively connects the signal processor (DDS) and the antenna-switch (SW, SW′),
- the antenna-switch (SW, SW′) comprises a multi-switch (MSW), a transmission-multiplexer (TxMUX) and a reception multiplexer (RxMUX), wherein said multiplexers (TxMUX, RxMUX) are controllable by the signal processor (DDS) via the multi-switch (MSW),
- the antenna (A, A_1, A_2, A_3, A_4) has a transmission-connector (CT_1, CT_2, CT_3, CT_4) for connecting the transmission path (Tx, Tx′) to the antenna (A, A_1, A_2, A_3, A_4) and a reception-connector (CR_1, CR_2, CR_3, CR_4) for connecting the reception path (Rx, Rx′) to the antenna (A, A_1, A_2, A_3, A_4),
- wherein the antenna-switch (SW, SW′), controllable by the signal processor, allows multi-frequency operation of the antenna-terminal (AT) by combining a transmission-mode and a reception-mode of the antenna (A, A_1, A_2, A_3, A_4).

2. Transceiver apparatus as claimed in claim 1, characterized in that the signal processor is an analogue-digital signal processor formed by a direct digital

synthesizer (DDS) driven phase locked loop (PLL) radio frequency (RF) signal generator.

3. Transceiver apparatus as claimed in claim 1 or 2, characterized in that the frequency conversion circuitry (3, 3′) comprises at least one of a local oscillator (O) and a power divider (D) to supply a local oscillator power to the transmission path (Tx, Tx′) and/or the reception path (Rx, Rx′).

4. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the frequency conversion circuitry (3) comprises a mixer device (Tx_2, Rx_2) for converting the signal between an intermediate frequency (IF) and a radio frequency (RF).

5. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the frequency conversion circuitry (3′) comprises a direct conversion device (Tx_1', Rx_1') for converting the signal between a base band frequency (zero IF) and a radio frequency (RF), in particular by means of an IQ-method.

6. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna switch (SW, SW′) comprises a matching unit (6) formed as a frequency regulated matching filter (Fig. 8) in order to provide an optimal matching factor for the antenna.

7. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna switch (SW, SW′) comprises a bus connection (6′) to the signal processor (DDS), wherein the bus-connection (6′) is formed as a matching network.

8. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna switch (SW, SW′) further comprises a beam forming

matrix device, in particular a Butler-output-matrix (BM) selected from the group consisting of: a 4x4, a 8x8 and a 16x16 Butler output matrix.

9. Transceiver apparatus as claimed in one of the preceding claims, characterized in that matching units (MF_1, MF_2, MF_3, MF_4) are provided inside the Butler-matrix (BM), in particular a modified Butler-output matrix output/input is formed as a frequency regulated matching filter (Fig. 10) in order to provide an optimal matching factor for the antenna.

10. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna terminal (AT) comprises a patching unit (PU) formed as a low-pass-filter to improve the matching of the antenna for different frequencies and/or for different modes of a multi-frequency communication system, in particular of a mobile cellular communication system or a personal communication system.

11. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna terminal (AT) comprises a matching unit for the antenna, in particular an LC component (L_1, C_1, L_2, C_2, L_3, C_3, L_4, C_4), in order to provide an optimal matching factor for the antenna.

12. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna terminal (AT) comprises at least two (Fig. 6), in particular four (Fig. 3), antennas.

13. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna is formed as an s-loop antenna having two ends (CP_1, CP_2) formed as the transmission connector and/or the reception connector.

14. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna is configured as a copper wired antenna, in particular

as a flexible line antenna made of copper.

15. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna is configured as a SMD-planar antenna.

16. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna has a body and the body comprises an integrated patching (PU) and/or matching unit (L, C).

17. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna terminal (AT) forms a beam of 360 degrees, in particular the antenna beam is formed within a range of 200 degrees (Fig. 11).

18. Transceiver apparatus as claimed in one of the preceding claims, characterized in that the antenna beam comprises a 90 degree beam, in particular the beam is formed by a 50 degree main beam and two 20 degree side beams (Fig. 12).

19. Base station for use in a multi-frequency communication system, comprising a transceiver apparatus (1, 1′) as claimed in one of the preceding claims.

20. Method of transceiving a multi-frequency signal in a multi-frequency communication system, comprising the steps of:

- processing the signal in a signal processor (DDS)
- frequency converting the signal in a frequency conversion circuitry (3, 3′)
- operating an antenna terminal (AT, AT′) by an antenna-switch (SW, SW′), and
- transceiving the signal by means of at least one antenna (A, A_1, A_2, A_3, A_4) of the antenna terminal (AT, AT′)

characterized in that

- frequency converting of the signal in the frequency conversion circuitry

(3, 3′) is established on a transmission path (Tx, Tx′) and a reception path (Rx, Rx′), wherein each of the paths communicates the signal between the signal processor (DDS) and the antenna switch (SW),

- multi-frequency antenna terminal (AT) operation is established by combining a transmission-mode of the antenna and a reception-mode of the antenna (A, A_1, A_2, A_3, A_4), controlled by the signal processor (DDS), by means of:
- the antenna-switch (SW, SW′) which comprises a multi-switch (MSW), a transmission multiplexer (TxMUX) and a reception multiplexer (RxMUX), wherein the multiplexers (TxMUX, RxMUX) are controlled by the signal processor (DDS) via the multi-switch (MSW), and
- communicating the signal between the transmission path (Tx, Tx′) and the antenna via the transmission multiplexer (TxMUX) and a transmission connector (CT_1, CT_2, CT_3, CT_4) of the antenna and between the reception path (Rx, Rx′) and the antenna via the reception multiplexer (RxMUX) and a reception connector (CR_1, CR_2, CR_3, CR_4) of the antenna.

21. Method as claimed in claim 20, characterized by directly frequency converting the signal in a frequency conversion circuitry (3′) between a base band signal (zero IF) and a radio frequency signal (RF).

22. Method as claimed in claim 20, characterized by frequency converting the signal in a frequency conversion circuitry (3) between an intermediate frequency signal (IF) and a radio frequency signal (RF)

23. Method as claimed in one of claims 20 to 22, characterized in that a reference of an incoming signal is processed in an antenna switch after checking a beam direction and a signal quality, in particular based on a BER- measurement.

24. Method of use of the transceiver apparatus as claimed in one of claims 1 to 19 in a multi-frequency communication system, in particular in a mobile cellular communication system, in particular a mobile cellular communication system having a

mode selected from the group consisting of: CDMA, FDMA and TDMA.

25. Method of use of the transceiver apparatus as claimed in one of claims 1 to 19 in a CDMA-FDMA/ TDMA and/or FDMA/TDMA (2.5G) multi-mode or combined system.

26. Method of use of the transceiver apparatus as claimed in one of claims 1 to 19 in a multi-frequency communication system, in particular in a personal communication system, in particular in a personal communication system having a mode selected from the group consisting of: PCS/N, 3G and GSM.

27. Method of use of the transceiver apparatus as claimed in one of claims 1 to 19 in a 3G / GSM multi-mode or combined system.

28. Method of use of the transceiver apparatus as claimed in one of claims 1 to 19 in a mobile cellular communication system in combination with a personal communication system.